

## METHOD OF ETCHING POLYSILICON GATE STACKS USING CARBON-CONTAINING GASEOUS ADDITIONS

### ABSTRACT

A method for making dual pre-doped gate stacks used in semiconductor applications such as complementary metal oxide semiconductor (CMOS) devices and metal oxide semiconductor field effect transistors (MOSFETs) is provided. The method involves providing at least one pre-doped conductive layer, such as poly silicon (poly-Si), on a gate stack and etching by exposing the conductive layer to an etching composition comprising at least one carbon containing gas. The carbon containing gas can be selected from gases having the general formula  $C_xH_y$ , such as, for example,  $CH_4$ ,  $C_2H_2$ ,  $C_2H_4$ , and  $C_2H_6$ . The carbon containing gas can further be selected from gases having the general formula  $C_xH_yA$ , wherein a can represent one or more additional substituents selected from O, N, P, S, F, Cl, Br, and I. The processes can result in dual pre-doped gate stacks having essentially vertical sidewalls and further having a width of at least about 3 nm, such as from about 5 nm to about 150 nm.